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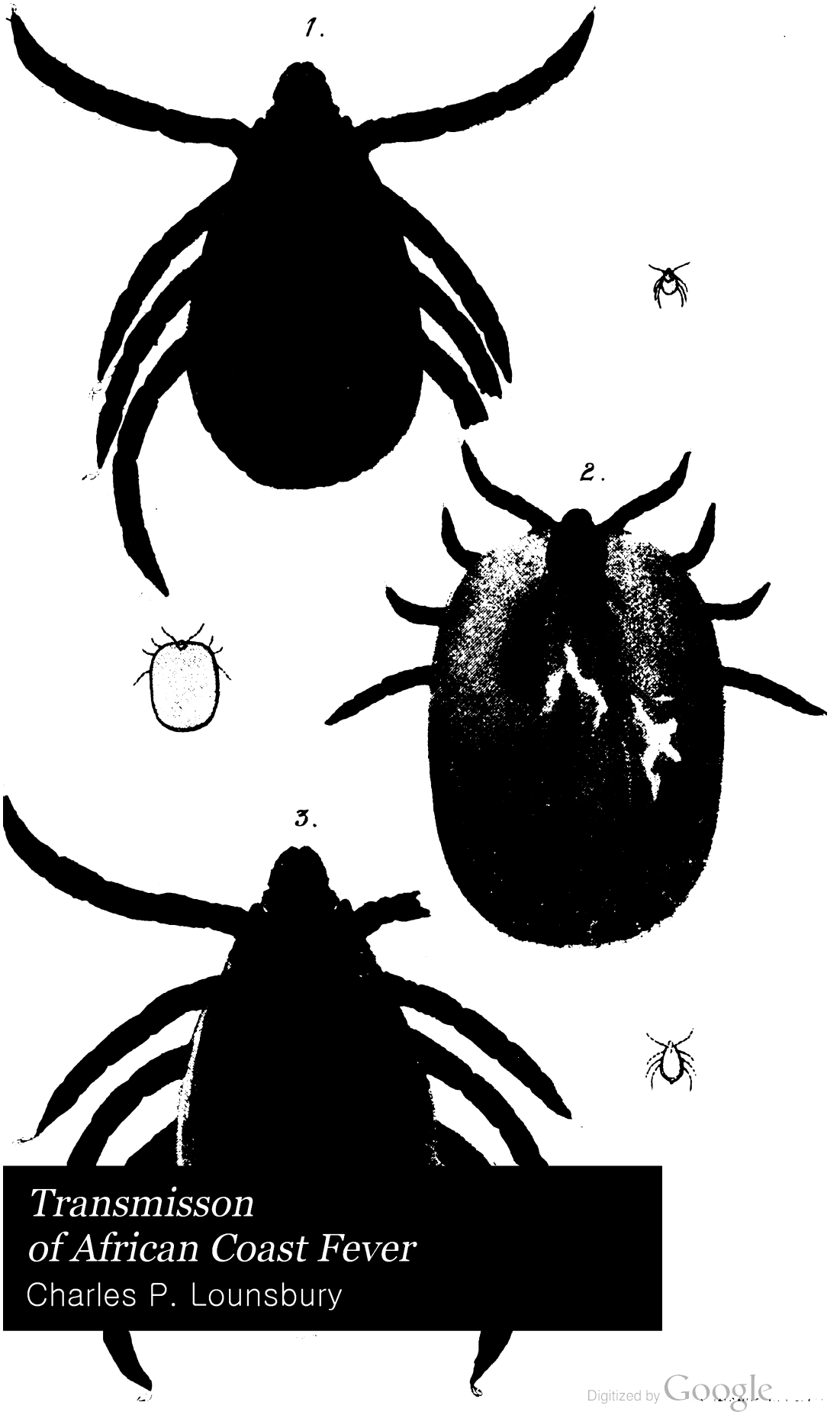

Transmisson of African Coast Fever

Charles P. Lounsbury

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Department of Agriculture.

TRANSMISSION OF AFRICAN COAST FEVER.

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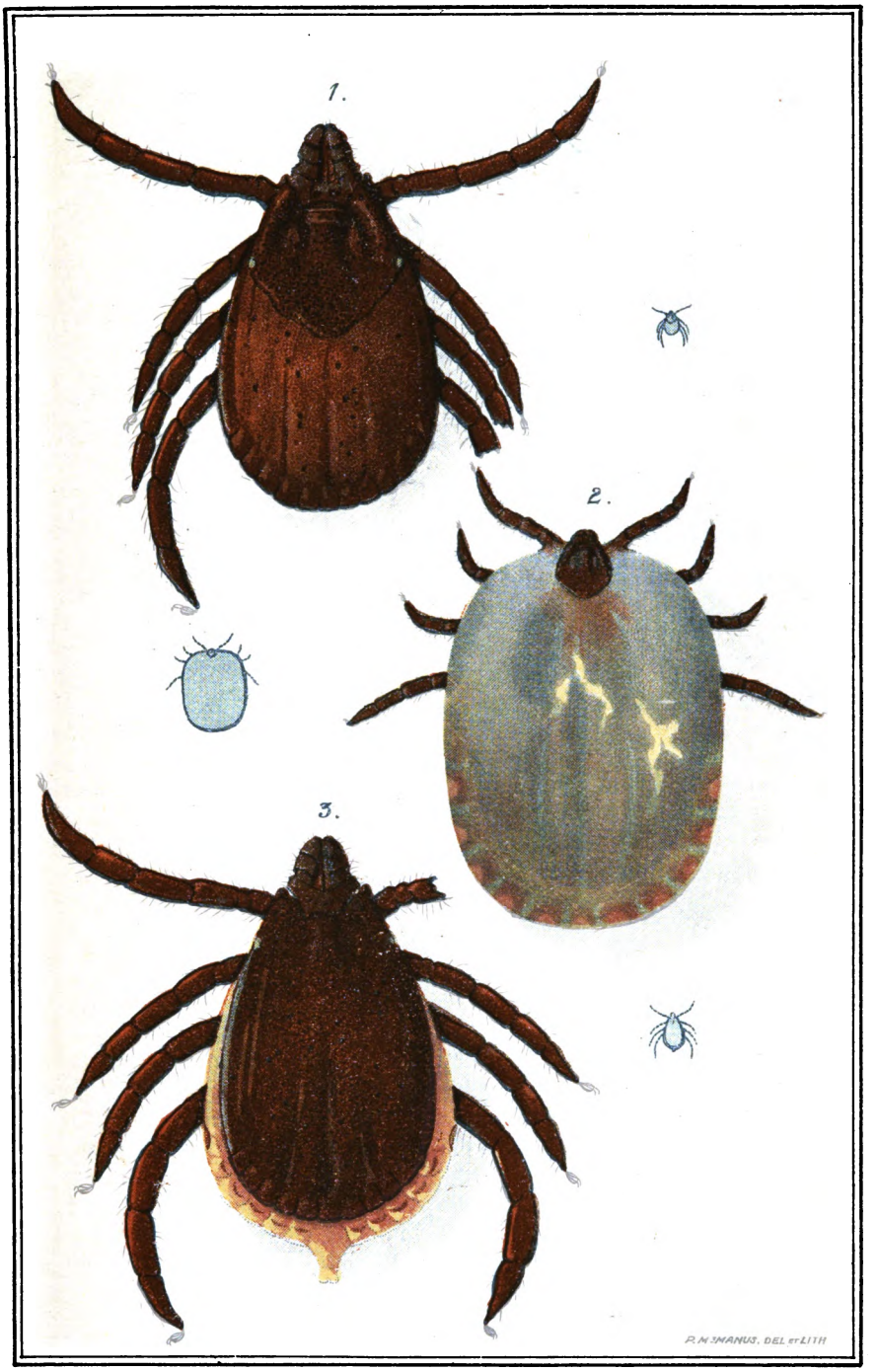
THE BROWN TICK.

(*Rhipicephalus appendiculatus*).



1. Female, before feeding—twelve times natural size. 2. Female, after feeding—four times natural size. 3. Male, after feeding—twelve times natural size

The outline figures show the natural sizes.

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TRANSMISSION OF AFRICAN COAST FEVER.

(By Chas. P. Lounsbury, Government Entomologist).

The three accompanying full page plates illustrate the Brown Tick (*Rhipicephalus appendiculatus*, Neumann), the principal, and, perhaps, the only natural transmitter of the highly fatal cattle disease called by Dr. Koch "African Coast Fever" but known better to many of our readers by the earlier applied name, "Rhodesian Redwater." The completeness of the illustrations renders an extended description of the tick unnecessary. As suggested by the common name, the predominant colour of the body of the adult is brown. There are, however, fully half a dozen distinct species of cattle-infesting ticks in the Colony that might be considered to merit the name "brown tick"; but from all the others, the one to which the name is reserved may be distinguished by the male having an almost smooth and glistening back, legs of the same colour, pale oval eyes, and—after it has fed a few days—a conical tail that is longer than wide. The sexes are produced in about equal numbers, but the males appear to greatly predominate because they remain far longer on the animal. The unfed female resembles the male in size and colouring, but the fed female would be mistaken for an abnormally large "Blue" or "Blood Tick" female by nine farmers out of ten.

The Brown Tick has a wide distribution. It has been collected or received by me from German East Africa, Delagoa Bay, various places in Rhodesia and the Transvaal, near the coast in Natal, and from the Komgha, East London, Peddie, Bathurst, Albany, Fort Beaufort, Uitenhage, Humansdorp, Knysna, Worcester, Paarl, Stellenbosch, and Cape districts of the Colony. Doubtless it occurs all along the eastern and southern coasts to Cape Town; and wherever it is found in numbers, there might the African coast fever be expected to spread more or less quickly if no effort were made to hold it back. There are a few slight but seemingly constant differences between the specimens of the Brown Tick found about Cape Town and those found in eastern Cape Colony and the northern States, but these differences appear insufficient to warrant the erection of a new species; the habits of all appear identical.

To comprehend the manner in which the infection of the disease is communicated, a knowledge of the life cycle of the tick is necessary. The Brown Tick, the same as other cattle ticks, has three feeding stages, all of which must be passed on an animal. The female drops from the skin when filled to the utmost with blood and

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in some shelter on the ground lays several thousand small eggs. Then she dies. The eggs may hatch in five weeks or may take as many months, according to the temperature. The tiny larval or first stage ticks climb to the grass tops or tips of bushes and are brushed off by passing animals. They quickly attach to any part of the skin and proceed to get their fill of blood. If on a favourable spot the feeding may be completed in three days, but if on an unfavourable one it may occupy ten days or more. As soon as distended with blood the larva lets go its hold and drops; it is then no larger than the head of a common pin. A fortnight or more is spent in digesting the store of food and in forming a new skin beneath the much stretched old one. Then the old skin ruptures across the back and the second stage or nymphal tick crawls forth with new mouth parts and new limbs as well as skin. The nymph can always be told from the larva by its having four pairs of legs instead of three pairs and by its larger size. Again an animal host is found and the body distended to the utmost with blood in the course of a few days; after this follows another drop and in due time a second change of skin and appendages. The fed nymph is little more than half as large as a grain of wheat and if noticed at all by a farmer would probably be mistaken for a small specimen of the Blue Tick female. The resulting adult, whether male or female, is distinctly brown as already described. It gets on to an animal from a bush or a grass top generally, and, by preference, attaches to the ear, not deep within like the young of the Red Tick but to the inner surface or along the hairy margin. Some specimens fasten about the face, especially to the eyelids, and many to the withers, sheath or udder, or legs, but the majority lodge on the ears. The male swells out very little by its feeding, however long it remains, the chief change effected in its appearance being due to a slight protrusion of the sides and of the tail-like appendage. The female awaits the male and after mating, swells very little for a few days; but then in the course of little more than a single day it fills out to about the size of a castor bean and drops off. Its feeding period when applied at the same time as a male is generally about nine days. The development of the various stages off the animal proceeds rapidly in summer weather but slowly in winter, and there is at the most, time for two generations only during one year. The hungry larva, nymph, and adult all have great vitality and are able to survive on the grass and bushes for several weeks without food; some nymphs at the office lived seven months over moist sand in a corked bottle. In rearing the species great difficulty was experienced in getting adults to attach and feed during the winter, whilst larvæ and nymphs fed almost as readily as during the summer. This observation is in keeping with the fact that the adults are very scarce on cattle except during the warm season; indeed few are found until after the middle of December in Cape Colony.

The Brown Tick is pre-eminently a cattle tick, but it may also infest many other animals. Adults have been taken from the ox, horse, ass, mule, sheep, goat, dog and cat. Larvæ and nymphs

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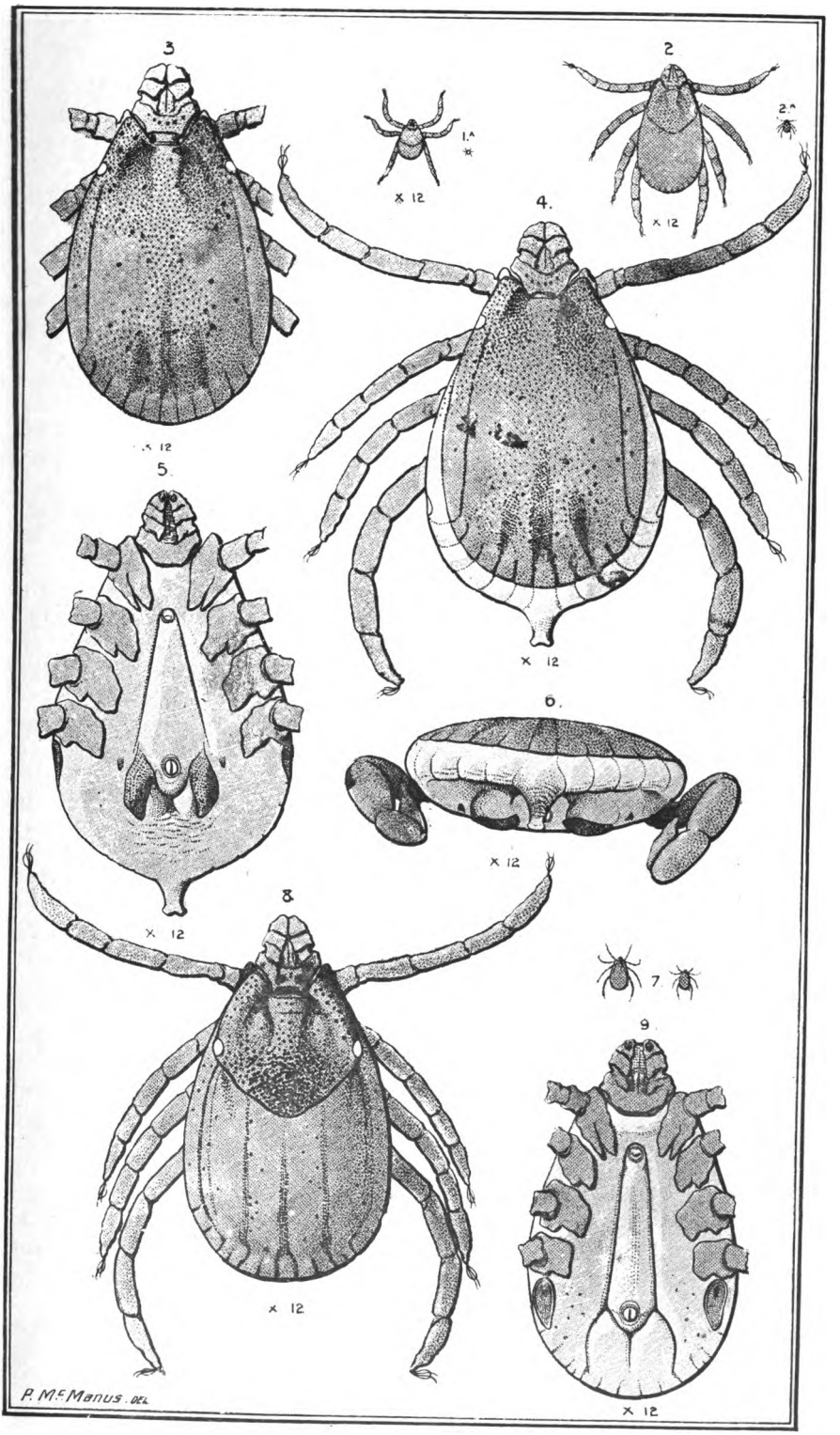

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have been readily reared on cattle and goats at the experiment station, and a small proportion of lots of nymphs applied to dogs and rabbits have fed to repletion.

The experiments which resulted in demonstrating the association of the tick with African Coast Fever were made by the writer in co-operation with the veterinary branch of the department. Further experiments are in progress. That the species could transmit the disease was first ascertained by a test made in November and December, 1902. Then a few specimens, which had as nymphs been taken from sick Rhodesian cattle and sent to the Cape by Chief Veterinary Surgeon C. E. Gray, produced a fatal case in our stables. Some months later two other oxen were fatally infected by specimens collected by the writer from sick Transvaal cattle. In these three cases, however, the history of the ticks before they went on the sick cattle from which they were taken was unknown, and hence there was some uncertainty as to the source of the infection. The later successful tests, on the other hand, were made with progeny of a lot of Brown Ticks collected for me by Mr. T. H. Warren from cattle on his farm near East London in this Colony, a place far removed from the African Coast Fever area. Most of this progeny was reared entirely on healthy animals and thus it was ascertained that no inherited infection of any kind was present. Moreover all the larvæ were fed on healthy cattle without any harm resulting.

The relatively few specimens from which the infection was secured were taken as hungry nymphs to Rhodesia and there fed by the writer on a cow whilst it was in high fever with the disease. The Rhodesian veterinary staff, headed by Mr. Gray, did all it could to assist me in finding diseased animals, and I also gratefully acknowledge my indebtedness to Messrs. Bett Bros., dairy farmers near Bulawayo, for most kindly placing sick cattle in their herd at my disposal. When full fed on the diseased animal the nymphs were brought back to Cape Town. Soon they moulted. Then, on the day after Christmas, about a dozen were placed on one ox, a few days later, about a dozen more on another, and a few days later still, about the same number on a third beast. The results were most decisive. The three animals sickened, each in its turn, about a fortnight after the infestation, and all succumbed. The cases were carefully watched by Mr. Robertson of the Veterinary Branch and by microscopical examination of the blood during life and by the lesions found at death were diagnosed by him

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BROWN TICK.

(Rhipicephalus appendiculatus.)

1, LARVA or SEED TICK, before feeding, twelve times enlarged; 1*a*, same natural size; 2, NYMPH or SECOND STAGE, before feeding, twelve times enlarged; 2*a*, same, natural size; 3, MALE ADULT, before feeding, twelve times enlarged; 4, MALE ADULT, after feeding a few days; 5, same from beneath; 6, same from behind; 7, same, natural size, the two figures showing how variable the size may be; 8, FEMALE ADULT before feeding, twelve times enlarged: 9, same from beneath. The female before feeding is the same size as the corresponding male.

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as African Coast Fever. The experiment was conducted in a newly built stable and there was no possible source of infection other than through the few ticks that were applied. The dozen or more other cattle at the station during the time all remained healthy.

A repetition of the experiment has shown that *a single tick* may give the disease. An old cow was infested with a lone female and in due time it fevered. At the same hour a two-year-old heifer was infested with two specimens, one a male and the other a female, and almost on the same day as the other this beast sickened. The cow is recovering but the heifer has succumbed. Uninfested cattle stalled alongside of these sick ones have remained quite healthy.

One of the first three animals and both the cow and the heifer last used were salted to redwater. Another of the first three was a beast that had been inoculated in the manner recommended by Dr. Koch. Mr. Robertson inoculated it ten times with blood from a recovered African Coast Fever animal which Dr. Koch himself pronounced suitable as a "bleeder." Ten c.c., of blood were used each time and the injections made once a week at first and later once a fortnight.

The infection, it is to be noticed, is taken up by the tick in one feeding stage and transmitted in the next. The transmissions in the last cases produced were all by adults which got the infection when nymphs, but one of the transmissions last year was by nymphs which must have got the infection when larvæ. The infection appears incapable of passing through the egg stage of the tick, as time after time we have fed tens of thousands of larval progeny, of Brown Tick females off sick animals, on our healthy cattle without in any instance producing fever. Numbers of such progeny, too, have been fed during all three feeding stages on healthy animals with a like absence of positive result. Dr. Koch has stated that the progeny of Blue Tick females off sick cattle may transmit the infection of this disease, but we have carefully tested ten different lots without getting a single infection. The progeny of Bont females from sick animals has also given only negative results, and no success was obtained in tests with a lot of Bont nymphs which as larvæ fed on a sick ox. It is also worthy to mention in this connection that the Bont Tick is practically absent from parts of Rhodesia where the disease has been very bad. Whether or not the Brown Tick ever passes the infection on to its progeny, or other species of ticks eve transmit the infection, it is certain that the transmission is not merely a mechanical transference of disease organisms from the sick to the healthy animals. In two tests made, large numbers of partly fed Brown Tick nymphs, that were taken from cattle just after they had been on the skin two days, were placed on healthy oxen; they fed to repletion on their new hosts but caused no disturbance of the health. It seems evident that the organism of the disease undergoes development within the tick, development which requires time and more warmth than suffices for the transformation of the tick itself, and that, therefore, the tick is as necessary for the propagation of the disease as is the animal. It does not appear, however, that the tick suffers in

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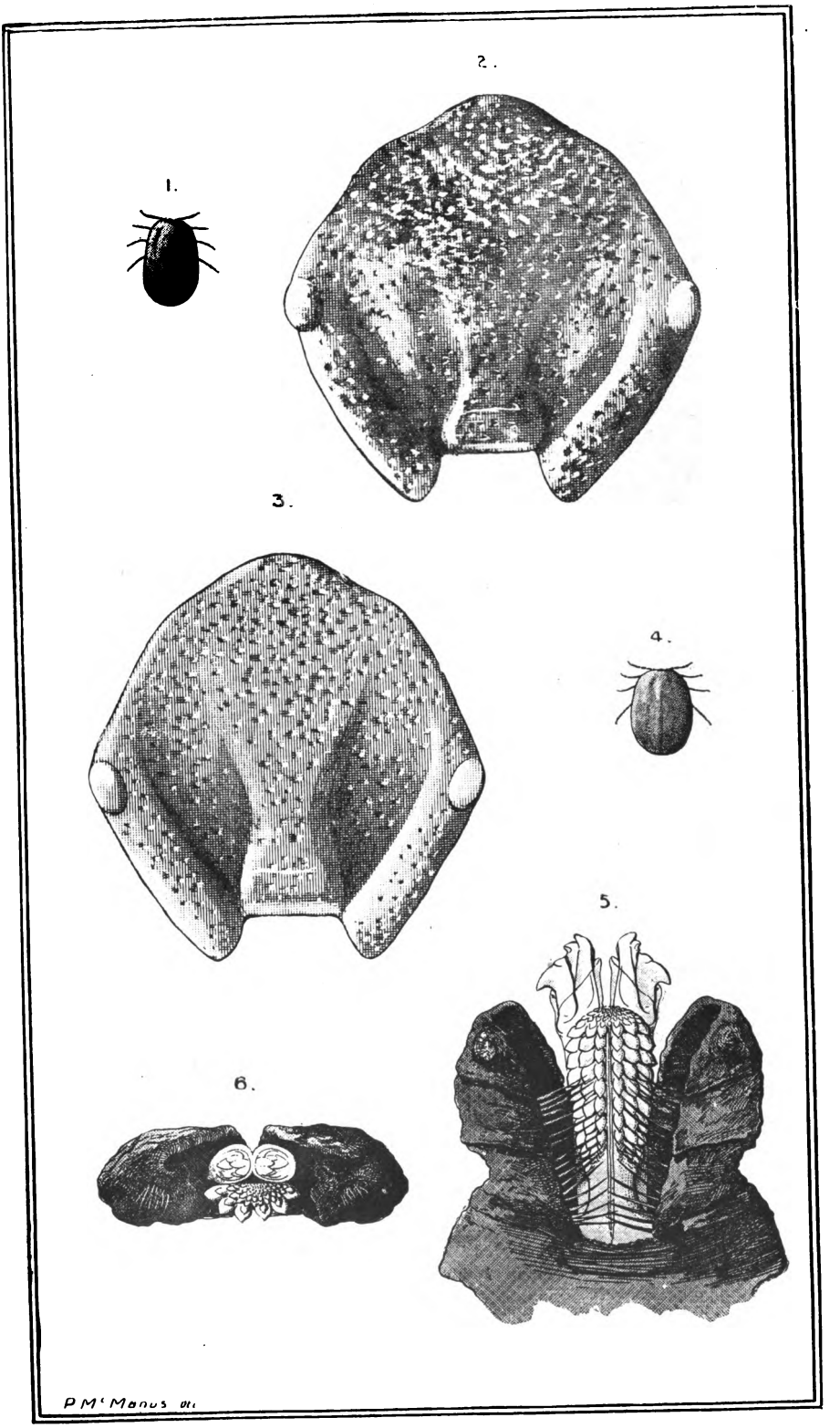

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health from harbouring the organism as does the immeasurably larger animal host.

The tick being necessary for the natural cycle of the disease organism, it follows that eradication of the tick or ticks that can carry the infection must prevent the spread of the disease, and suppress it where it occurs. The same reasoning applies to Redwater and Heartwater. The problem of tick destruction is, therefore, of the greatest importance to stock farmers in the infected districts.

Fortunately, an effectual remedy for the tick pest is now known to be at hand in arsenical dips. Queensland farmers have been cattle dipping several years, and now that some South African farmers have demonstrated the great success of the treatment for themselves, its general adoption is only a question of time. The writer, within a few days, had the pleasure of witnessing dipping operations on Mr. Campbell's farm, near Fort Beaufort, the equipment of which was described in the *Agricultural Journal* a couple of months ago. A year ago the place was bad with ticks. Dipping every fourteen days has now been carried on for about nine months, and already the improvement is very great. The Blue Tick is hardly to be found, and the Bont is chiefly represented by larval ticks, doubtless from eggs laid nearly a year ago. No harm has resulted to the cattle, although all, old and young, and both sexes, are run through. I was told that cows about to calve, and those just calved suffer no injury; and, indeed, the only injury experienced, it was stated, was a slight scalding and stiffness when the dip was not thoroughly mixed. An easily mixed proprietary dip is used, and the cattle run through at the rate of ten to twelve a minute. Few needed urging to make them take the plunge, and many had to be restrained, so eager were they for the bathe. Horses are put through, too, and give no trouble. Ostriches were treated on one occasion and seemed none the worse afterwards. The tank, however, has proved too long and deep for small stock, some of which perished from the effects of swallowing the mixture.

Cattle are the chief hosts of the Bont, Blue, and Brown adult ticks, and horses carry more adults than small stock. The dipping of these large animals at short intervals can, therefore, be depended on to vastly decrease the tick pest. To see is to believe, and farmers in the tick areas, who have not seen dipping and its good effects, are urgently recommended to take their earliest opportunity to do so.

BROWN TICK.

(Rhipicephalus appendiculatus.)

1, FEMALE, natural size as found in south-western districts of Cape Colony, after complete engorgement; 3, SHIELD of same much enlarged: 4, FEMALE, natural size after engorgement, as known elsewhere in South Africa; 2, SHIELD of same, much enlarged; 5, MOUTH PARTS of same, much enlarged and seen from beneath; 6, same seen from the top.

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